Internet Modem Streaming Socket Method

CROSS-REFERENCE TO RELATED APPICATIONS

This application is related to U.S. provisional patent application Serial no.
5   60/247,265, filed on October 16, 2000.

TECHNICAL FIELD

The invention relates generally to Internet communication technology, and
more particularly to a system and method that provide streaming socket
10   connection between Internet client and Internet server through an Internet
modem.

BACKGROUND OF THE INVENTION

A standard modem can be in either one of two modes, command mode or
15   data mode. In a command mode, no data is passed across the modem. The
modem operation is controlled using standard modem "AT" or other
commands. When the modem is connection to another modem, it goes into

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data mode. Changing back to command mode can be done with an escape sequence.

As for any standard modem, the following guidelines are used when issuing commands:

5
- When using "AT" commands, start every command line (except the "A/" and "+++" commands) with an attention ("AT") code characters. Otherwise, the modem will not execute the command.

- The commands following the "AT" prefix can be uppercase, lowercase, or a combination of both.

10
- Always type the "AT" prefix in the same case (not "At" or "aT") .

- Telephone numbers may be entered with or without punctuation.

- Commands must be terminated with a carriage-return character. This is typically ASCII 13 (0x0D). However, it can be changed by modifying the modem S-Register number 3.

15
Each command line to a modem has the following format (with the exception of the "A/" and "+++" commands):

```
<AT><Command>{Argument}{=n}{  }
```

Wherein "`<AT>`" is the attention code, "`<Command>`" is a command consisting of one letter of an ampersand ("`&`"), percent ("`%`"), or backslash ("`\`") followed by a letter, "`{Argument}`" is optional information specific to

5   the Command, and "`{=n}`" is used in some instance to qualify an Argument specific to the Command. The information in angle brackets ("`<>`") must be included as part of the command line, while information in curly braces ("`{}`") may or may not be necessary as part of the command line. It is also possible to string commands together in one command line. The attention code "`AT`"

10 is only required at the beginning of the command line.

In the command mode, characters received from the serial port are interpreted as commands and must follow the guidelines described above. The modem transitions from the command mode to the data mode after a successful "`ATD`" command or after receiving a call in auto-answer mode. To

15 transition from the data mode to the command mode, an escape, either a sequence of characters or toggling the DTR line, must be sent to the modem. This sequence is typically "`+++`", however, this can be changed to another repeated character by modifying the modem S-Register number 2. Typically, a delay with no data transfer of one second before and after this escape

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sequence is required. This time delay can be changed by modifying the

modem S-Register number 12. The "ATO" command is used to resume the

data mode without having to hang-up and redial.

A separate TCP socket application is usually added to establish Internet

5   connection once the modem is in data mode. However, it is often desirable

that a TCP streaming socket can be opened on the modem so that an Internet

client can directly communicate with an Internet server over the socket.

SUMMARY OF THE INVENTION

10   The streaming sockets technology according to this invention offers power

and flexibility that are not garnered by traditional service based on batch

commands excited in command mode.

A streaming socket is a highly efficient way of utilizing a TCP socket over an

asynchronous or synchronous serial data channel like an RS-232 serial port

15   without the need for complex framing or encapsulation. It allows the client

device to send and receive data over a TCP socket by simply reading and

writing characters on the data channel. The streaming-socket doesn't need to

know beforehand how much data is going to be exchanged, it simply allows a free flowing stream of data between the TCP socket and the client over the data channel. It also incorporates the concept of a streaming socket timer that allows the streaming socket to efficiently packetize the serial data stream into TCP segments. The socket streaming timer is tunable to provide maximum efficiency when utilized from various types of data sources, whether interactive or machine driven. Streaming sockets are also an effective way to share the data channel with many TCP sockets.

An Internet modem provides full modem functionality in addition to the Internet connectivity. The interface to the Internet modem is identical to that of a standard modem. Standard "AT" modem commands can be issued to the Internet modem and the behavior is the same as it is for a standard modem.

The internet modem is an extension of the command mode and data mode idea used in standard modem. In an Internet ready modem, there are two Internet session modes besides the standard command mode and data mode. The Internet session modes are Internet session command mode and Internet session streaming socket mode. The standard command mode and data mode are same as these of a standard modem. A "T" command or an "R" command enables Internet session streaming socket mode. Once in Internet

session streaming socket mode, any data sent to the Internet modem is sent across the TCP socket, and data received on the socket is sent from the modem. Internet session streaming socket mode can be terminated by the standard modem escape sequence or by toggling the DTR. Once in Internet session command mode, the last streaming socket can be resumed, or another streaming socket can be started or resumed.

The Internet modem dials up an Internet Service Provider (ISP) and uses data mode to send a username and password string to the ISP. Once the username and password have been accepted, it returns to command mode by escaping out of data mode. Once back in data mode, PPP is raised, a TCP connection is initiated and Internet session streaming socket mode is entered. The TCP transaction is completed via the streaming socket. Once completed, Internet session streaming socket mode is escaped back into Internet session command mode where the socket can be closed and more commands can be executed.

Several streaming sockets can be used at the same time by escaping out of one streaming socket and creating or entering another streaming socket.

The communication method provides a straightforward way to transmit and

receive data with an HTTP server. This is not limited to HTML content

because any ASCII data can be transmitted via HTTP. The use of CGI can

make this a powerful tool. Alternatively, an Internet client can use the Internet

5   modem to communicate to an SMTP server.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block schematic diagram showing a computer network comprising

an Internet server and an Internet client that contains an Internet modem;

10   FIG. 2 is a flow diagram of a method for establishing the communication

between the Internet client and the Internet server through the Internet

modem;

FIG. 3 is a diagram showing sample command sequence to establish a TCP

connection over a streaming socket;

15   FIG. 4 is a state transition diagram for the Internet ready device; and

FIG. 5 is a state transition diagram showing the flow from connecting a TCP

socket to a streaming socket, using the streaming socket and closing

streaming socket.

5   **DETAILED DESCRIPTION OF THE INVENTION**

A. THE COMMUNICATIONS NETWORK

FIG. 1 is a block schematic diagram that illustrates a computer network 10

comprising of an Internet client 11, an Internet modem 12, and an Internet

10   server 18.   The Internet modem 12 contains a Streaming Socket 13, a

command processor 14 that interprets an Internet ready command line

interface, and a TCP/IP stack 15.

The Internet client 11 communicates with the Internet modem 12 through the

Internet Ready command line interface over an RS-232 serial port 17. The

15   command processor 14 instructs the TCP/IP stack 15 to open and close

sockets, send and receive data, and provide other network functionality. The

command processor 14 can also switch the Interne modem to Internet

session streaming socket mode where the streaming socket 13 is attached

directly to an open socket in the TCP/IP stack 15 and the serial port 17. The

streaming data is sent from the Internet modem 12 to the Internet server 18

through a phone system 18.

5   The Internet modem 12 also contains the following Internet specific S-

Registers:

- S0-S1: Socket 0/1 Status

These registers read the operating status of the two physical sockets in the

Internet modem 12. They each contain a 3-character string that represents

10   their current status. These registers are read-only. Any attempt to write to

them will fail silently.

- S2-S3: Socket 0/1 Source Port

These registers read the source port of the two physical sockets in the

Internet modem 12. They are either set by a parameter in a "T" command or

15   randomly generated if the parameter is omitted. These registers contain a

character string that represents the port number. Valid port numbers are

between 1 and 655535. These registers are read-only. Any attempt to write to them will fail silently.

- S4: IP Address of Internet modem

This register stores the local device IP address. If the Internet modem is used with a static IP address, this register must be set with a valid address before the "c" command is executed. If this value is not set before "c" command is executed, the Internet modem 12 negotiates a valid "IP" address during PPP negotiations. In that case, the value is only valid while PPP is active, between the execution of a "c" command and "D" command. It then shows the current negotiated IP address for the Internet modem 12. The register contains a character string that represents the IP address. The string is in the "dotted decimal" format: xxx.xxx.xxx.xxx (i.e. 192.168.2.10). When the IP address is invalid, it returns the invalid IP address: 0.0.0.0.

- S5: Primary DNS Server

This register stores the primary DNS server address. If the register is not set, hostname lookups will fail. The register contains a character string that represents the IP address. The string is in the "dotted decimal" format:

xxx.xxx.xxx.xxx (i.e. 192.168.2.10). When the IP address is invalid, it returns

the invalid IP address: 0.0.0.0.

- S6: IR Configuration Byte

This register returns or can be set with a ASCII hex byte. The byte is

5   assembled with the following bits:

0x01   = Echo in Command Modes (0=off\1=on(default))

0x02   = Echo in Streaming Socket Mode (0=off\1=on(default))

0x04   = Result Codes Verbose (0=off\1=on(default))

0x08 =   Internet   Mode   Escape   Sequence   (inband   escape)

10   (0=off\1=on(default))

0x10   = Internet Modem Data Mode Escape (0=off\1=on(default))

0x80   = Debug Streaming Socket Marker (0=off(default)\1=on)

- S7: TCP Stream Tick Time

This register contains the TCP Stream Tick Time used to determine when to send TCP segments. Valid range is 0 through 255 units. Each unit is equal to 10ms. Default is 50.

- ### SE: EEPROM Read/Write/Play Slots

5   This register lets the user take advantage of non-volatile memory that may exist on the device. The EEPROM memory is divided up into slots of 32 characters each. The number of slots available is dependent on the system design, typically 8 or 16. Slot 0 is a special slot that is automatically executed on modem power-up and is useful to set the modem in a default state on

10 power-up. Slots can be used for AT commands, IR commands, or for user storage. Data can be written to slots, read from slots, or sent to the IR and AT command processors for "playback". Multiple commands can be stored for playback in one slot if separated by the "`" (backward single quote) character.

For example:

15 To store a reset modem command and DNS server init command that will execute on reset:

irse0=ATZ`irs5=192.168.1.1

To echo slot zero back:

irse0

To playback slot 1 to the IR and AT command processors:

irse1!

5   To store a dial string in slot 2:

irse2=ATDT9,5559874

B. THE COMMAND LINE INTERFACE

The Internet modem 12 extends the standard modem modes with two

10   additional Internet session modes. When the Internet modem 12 is not in the

Internet session modes, it behaves exactly like a standard modem, and can

be in either the command mode or data mode. In the Internet session modes,

the Internet modem 12 can be in either Internet session command mode or

Internet session streaming socket mode. However, the Internet modem 12

15   does not behave exactly like a modem in these two modes. In Internet

session command mode, characters received from the serial port are

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interpreted as commands and must follow the guidelines described above. In

this case, only "IR" commands are interpreted by the command processor

14. Standard modem "AT" commands are not supported in this mode. In

Internet session streaming socket mode, the Internet modem receives

5   characters from the serial port, converts the data to Internet protocol packets,

then converts them to analog signals and transmits these signals over the

telephone line.

The Internet ready command line interface accepted by the command

processor 14 consists of several "IR" commands. These "IR" commands

10   follow the same guidelines as the stand modem "AT" commands:

- When using "IR" commands, start every command line (except the

    "+++" commands) with the Internet ready ("IR") code characters.

- The commands following the "IR" prefix can be uppercase,

    lowercase, or a combination of both.

15   - Always type the "IR" prefix in the same case (not "Ir" or "iR").

- Commands must be terminated with a carriage-return character. This is

    typically ASCII 13 (0x0D). However this can be changed by modifying

    the modem S-Register number 3.

Each command line to a modem follows the format:

```
<IR><Command>{Argument}
```

Wherein "`<IR>`" is the Internet ready code, "`<Command>`" is a command consists of one letter, and "`{Argument}`" is optional information specific to

5 the Command. The information in angle brackets ("<>") must be included as part of the command line, while information in curly braces ("{ }") may or may not be necessary as part of the command line. For the "`IR`" commands, it is not possible to string commands together in one command line.

The Internet ready command line interface 14 includes the following "`IR`"

10 commands:

- "`C`" command to initialize the connect mode

This command starts device connection and negotiates PPP. It may take some time to return. When finished, the Internet modem transitions to Internet session command mode. Only "`IR`" commands can be sent to the Internet

15 modem after this command executes. The syntax of this command is

```
IRCn{username, password}
```

Wherein n can be 0 or 1 with a default value of 0. When n is set to 1, PAP

authentication is used, and therefore the username and password must be

provided. The username and password represents the PAP authentication

user name and password respectively. The possible responses that may be

5   returned include:

"CONNECT" (1) : Connection is established

"ERROR" (4) : Invalid command format

"PPP FAILED" (80) : PPP negotiation failed

- "D" command to terminate the connect mode

10   This command starts device termination and device terminates PPP. When

finished, the Internet modem 12 transitions to standard modem command

mode. The syntax of this command is

IRD

No parameters are needed for this command. The possible responses that

15   may be returned include:

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"OK"　(0)：Command executed. Return to standard modem command mode

"ERROR"　(4)：Invalid command format

"PPP DOWN"　(81)：PPP is not up

5　• "T" command to connect to TCP server

This command starts device connection to server through TCP socket. When finished, the Internet modem transitions to Internet session streaming socket mode. Any data sent to the serial port is sent through the open TCP socket. To return to Internet session command mode, the Internet modem must be

10　escaped or the server must terminate the TCP connection. The syntax of this command is

IRTn,<server:port>{;}

Wherein n can be 0 or 1 to specify the socket number to connect, server is the IP address or name of the server to connect to, port is the TCP port

15　number on the server to connect to. If the last character on the command line is a semicolon, the Internet modem 12 returns to Internet session command mode rather than the Internet session streaming socket mode. The

connection is still created and alive. The possible responses that may be
returned include:

"OK" (0) : Command executed. Return to command mode.

"CONNECT" (1) : Connection is established

5   "ERROR" (4) : Invalid command format

"PPP DOWN" (81) : PPP is not up

"TCP FAILED" (82) : TCP negotiation failed

"SOCKET INUSE" (85) : Socket already in use

"SOCKET RESET" (86) : Socket reset by peer

10   • "R" command to resume socket connection

This command resumes Internet session streaming socket mode with the
selected socket. The socket must have been connected with either a "T"
command with a ";" argument, or "T" command and then escaped with
"+++". The Internet modem 12 transitions to Internet session streaming

15   socket mode. To return to Internet session command mode, the Internet

modem 12 must be escaped or the server 18 must terminate the TCP

connection. The syntax of this command is

IRRn

Wherein n can be 0 or 1 to specify the socket number to resume. The

5   possible responses that may be returned include:

"OK" (0) : Command executed. Return to command mode

"CONNECT" (1) : Connection resumed

"ERROR" (4) : Invalid command format

"PPP DOWN" (81) : PPP is not up

10   "SOCKET DOWN" (84) : Socket not connected

● "X" command to release socket connection

This command closes the selected socket and releases the socket resources.

The syntax of this command is

IRXn

Wherein n can be 0 or 1 to specify the socket number to release. The possible

responses that may be returned include:

"OK" (0) : Command executed

"ERROR" (4) : Invalid command format

"PPP DOWN" (81) : PPP is not up

"SOCKET DOWN" (84) : Socket not connected

- "U" command to allocate UDP socket

This command sets up a socket resource to allow UDP communications. The

syntax of this command is

IRUn,<port>

Wherein n can be 0 or 1 to specify the socket number to allocate, port is the

UDP port number to listen for packets on. The possible responses that may

be returned include:

"OK" (0) : Command executed.

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"ERROR" (4) : Invalid command format.

"PPP DOWN" (81) : PPP is not up.

"SOCKET BUSY" (90) : Socket is already in use and must be
released first.

5 • "G" command to get UDP data from socket.

This command returns a UDP datagram from socket if it exists. The syntax of
this command is

IRGn

Wherein n can be 0 or 1 to specify the socket to check for data on. The
10 possible responses that may be returned include:

"OK" (0)ip:port,len:[data]cr/lf: Datagram is available and
returned, wherein ip is 4 bytes, port is 2 bytes, len is 2 bytes and
data is len bytes

"ERROR" (4) : Invalid command format

15 "PPP DOWN" (81) : PPP is not up

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"NO DATA" (81) : No data is waiting

"SOCKET DOWN" (81) : Socket not allocated

- "P" command to put data out UDP socket

This command sends a UDP datagram containing desired data. The syntax of

5   this command is

IRPn, <server:port>,<len:[data]>

Wherein n can be 0 or 1 to specify the socket to send data to, server is the

IP address or name of the server to send datagram to, port is the UDP port

number to send datagram to, len is 2 byte to specify the length of data. The

10   possible responses that may be returned include:

"OK" (0) : Datagram was sent

"ERROR" (4) : Invalid command format

"PPP DOWN" (81) : PPP is not up

"NO DATA" (81) : No data is waiting

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"SOCKET DOWN" (81) : Socket not allocated

- "S" command to set or show S-Register

This command is used to set and show the Internet specific S-Registers of the Internet modem12. The registers are used to store various operating

5   parameters of the Internet modem 12. The syntax of this command is

    IRSn?, IRSn=y

Wherein n specifies the Register number to access, y is the new value to set the register to.

- "O" command to turn off Internet session modes

10   This command turns off the Internet session modes. It can not be turned back on except by reset the power. The syntax of this command is

    IRO

A result code is issued from the Internet modem 12 for standard "AT" commands as well as "IR" commands. The result codes may be issued in

15   either of two possible formats: words (the long form, also known as verbose) or numeric characters (the short form, represented by digits). The result code

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format is set using the "ATV" command, ATV1 (default) for words, and ATV0

for numeric characters.

Word result codes are preceded and followed by a carriage-return (typically

ASCII 13 (0x0D)) and line-feed (typically ASCII 10 (0x0A)) character. These

5   characters are defined by modem S-Registers numbers 3 and 4. Numeric

character result codes are terminated by the same carriage-return character

that command lines are terminated with (ASCII 13 (0x0D)).

One can modify or change the values of an S-Register from the command

mode with the "ATSn=" command. One can read the current value of an S-

10   Register from the command mode with the "ATSn?" command.

The command processor 14 interprets some standard modem "AT"

commands that modify the command mode interface. These include "ATE"

for setting the echo mode, "ATV" for changing the result code format, and

"ATS" for changing the interface command characters. These commands

15   affect the command mode for both the "AT" commands and the "IR"

commands.

C. CONNECT INTERNET CLIENT TO INTERNET SERVER

Now referring to FIG. 2, illustrated is a flow diagram 20 of a method for

establishing the communication between the Internet client 11 and the

Internet server 18 through the Internet modem 12. The method includes the

5   following steps:

   21. Checking whether an Internet modem is present.

   Command to Modem: `IR`

   Response from Modem: `OK`

   22. Dialing the modem to a destination number switching modem to data

10 mode.

   Command to Modem: `ATDT14089614565`

   Response from Modem: `CONNECT`

   The sample command is shown as 301 and the response is shown as

   302 in the command sequence diagram (FIG. 3).

15   23. Escaping the Internet modem from data mode to command mode.

Command to Modem: +++

Response from Modem: OK

The sample command is shown as part of 302 in the command
sequence diagram (FIG. 3).

5   24. Connecting to the POP and negotiating a PPP connection using the

"C" command and switching the Internet modem 12 to Internet

session command mode.

Command to Modem: IRC1username, password

Response from Modem: CONNECT

10   The sample command is shown as 303 in the command sequence

diagram (FIG. 3).

25. Connecting to the Internet server 18 using the "T" command and

establishing a TCP socket connection for one streaming socket.

Command to Modem: IRT0,192.168.1.20:80,4321

15   Response from Modem: CONNECT

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The sample command is shown as 304 in the command sequence diagram (FIG. 3).

26. Performing necessary Internet transactions between the Internet client 11 and the Internet server 18. This step is also shown as 305 in FIG. 3.

5   The Internet client 11 can post data to a CGI script on an HTTP server and receive response from the server. Alternatively, the client can connect to an SMTP server and send out emails to target email addresses.

27. Escaping the Internet modem 12 from Internet session streaming socket mode to Internet session command mode.

10   Command to Modem: +++

Response from Modem: OK

The sample command is shown as 306 in the command sequence diagram (FIG. 3).

28. Releasing the socket connection using the "X" command.

15   Command to Modem: IRX0

Response from Modem: OK

29. Terminating the socket connection using the "D" command.

Command to Modem: IRD

Response from Modem: OK

5   30. Hanging up the Internet modem 12 using standard "ATH" modem

command.

Command to Modem: ATH

Response from Modem: OK

FIG. 4 shows the state transition diagram for the Internet modem. The Internet

10   modem transits from Internet modem command mode to Internet modem data

mode after a successful "ATD" modem command (401). It then transits back

to Internet modem command mode following an Escape sequence (402). An

"IRC" command negotiates PPP connection and transits the Internet modem

to Internet session command mode (403) and an "IRT" or "IRR" command

15   opens or resumes a TCP socket and transits the Internet modem to Internet

session streaming socket mode (404). An escape sequence transits the

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Internet modem to Internet session command mode (405) and an "IRD"

command transits the Internet modem to Internet modem command mode

(406).

The method described above assumes the negotiating of a PPP connection is

5   using the Password Authentication Protocol. However the method is equally

applicable when negotiating of a PPP connection does not use the Password

Authentication Protocol.

While escaping back to Internet session command mode, another command

can be executed. This is shown as 307 in FIG 3. One can create another TCP

10   connection attached to other streaming sockets and perform interaction

between the Internet client and a second Internet server by escaping out of

one streaming socket.

FIG. 5 is a state diagram shows the flow from connecting a TCP socket to a

streaming socket, using the streaming socket, and closing the streaming

15   socket (leaving the TCP socket connected). The state transition comprises the

following steps:

• Step 501: Starting streaming socket at an idle state.

- Step 502: When connecting TCP socket to Streaming socket, resetting streaming socket timer counter and streaming socket send buffer to zero.

- Step 503: Streaming socket is now in connected mode.

- Step 504: When escaping from streaming socket mode to idle state, forcing send buffer out TCP socket.

- Step 505: When Internet client sending character, placing received character into streaming socket send buffer and resetting the streaming socket time counter.

- Step 506: If send buffer is not full, keeping the received characters in streaming socket send buffer.

- ·Step 507: If send buffer is full, forcing send buffer out TCP socket.

- Step 508: If streaming socket send buffer has data, forcing out TCP socket and resetting streaming socket timer counter.

- Step 509: When TCP segment is received on the streaming socket, sending data to Internet client.

The sending of TCP packets from the streaming socket buffer is controlled by a Streaming socket timer. The streaming socket timer is usually a value between 1 milliseconds and 5 seconds. When a client sends a character to the streaming socket the timer is reset and starts counting down. If the streaming socket doesn't receive a character before the timer expires it will send any data waiting to be sent across the TCP socket. This allows data to be packaged up into groups instead of sending one packet for each character or having to know beforehand how many characters the client will be sending. Slower timer values can provide efficiencies even for interactive use.

D. CONNECT TO AN HTTP SERVER

In one embodiment, the Internet server 18 is an HTTP server. A simple CGI program on the HTTP server can accept an HTTP GET with data parameters, and process the data, possibly checking for checksums included in the data, possibly parsing the data for specific information. A response can be generated on the fly and returned in the same HTTP GET transaction, possibly containing status, or configuration information. The data can then be stored in a database or simple file. This also provides a capability for dynamic formatting a presentation of the data in HTML format for a web browser. This

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can be done through various means, depending on the data storage and the Web tools available. The Internet client 11 established a TCP streaming socket 13 to the HTTP server 18 as described in the above section.

Once a TCP streaming socket 13 is established, the Internet client 11 may communicate with the Internet server 18 through the Internet modem 12 as illustrated in the following steps:

- Performing a GET to a CGI program running on the HTTP server by the Internet client;

- Sending parameter data to the CGI program by the Internet client;

- Parsing the parameter data and saving it to the HTTP server by the CGI program;

- Returning data from the CGI program to the Internet client 11. The data can be viewed through a PC web browser.

After the Internet transaction has been performed, the TCP streaming socket 13 can be released and the modem 12 is hang up as described in the above section.

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E. CONNECT TO A SMTP SERVER

The TCP streaming socket 13 also provides a straightforward way to transmit data with an SMTP server. In another embodiment, the Internet server 18 is

5 an SMTP server. The Internet client 11 uses the Internet modem 12 to send data to a specific email address through the SMTP server.

Once a TCP streaming socket 13 is established, the Internet client 11 may communicate with the Internet server 18 through the Internet modem 12 as illustrated in the following steps:

10 • Entering a return email address by the Internet client 11;

• Entering one or more target email addresses by the Internet client 11;

• Sending data to the SMTP server by the Internet client 11. The data can be retrieved from the mailbox of the target email address.

After the Internet transaction has been performed, the TCP streaming socket 13 can be released and the modem 12 is hang up as described in the above section.

5   Although the invention is described herein with reference to the preferred embodiment, one skilled in the art will readily appreciate that other applications may be substituted for those set forth herein without departing from the spirit and scope of the present invention.

Accordingly, the invention should only be limited by the Claims included 10   below.